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However, we admit that it is often very difficult to obtain material so well represented as to include the root-system, especially of herbarium specimens.—THEO. HOLM.

**Anatomy of the leaves of Ranunculaceae.**—GOFFART<sup>11</sup> has described the leaf structure of species representing 23 genera of Ranunculaceae, nearly all from the old world. The paper is illustrated by about 400 excellent figures of the leaf outline and the internal structure. So many anatomical details are recorded that an abstract in brief space is impossible.

The author has followed the method suggested by his teacher, the distinguished anatomist A. GRAVIS, to examine the leaf at very many places and at various stages of its development, and to give due consideration to the course of the mestome strands from stem to petiole and throughout the blade. In this way one obtains a most complete idea of the structural peculiarities, and such are highly welcome to students of affinities, expressed not only by floral structures but also by internal organization. Much has been written about the validity of several of these genera, considered from a systematic point of view, especially judging from the floral characters. It is therefore interesting to learn from this paper that, so far as concerns the leaf structure, *Hepatica* is not distinct from *Anemone*, and the same seems to be the case with *Nigella-Garidella*, *Actaea-Cimicifuga*, and *Ficaria-Oxygraphis-Ranunculus*. However, in respect to *Oxygraphis*, the author has examined only *O. Cymbalaria*, which in the reviewer's opinion is no true *Oxygraphis*, but a *Ranunculus*. An examination of *O. glacialis*, for instance, would no doubt have led to a different conclusion. On the other hand, *Pulsatilla* appears to be generically distinct from *Anemone*, and *Batrachium* from *Ranunculus*. Future investigations, for instance, of the singular North American representatives of *Ranunculus* constituting the section *Crymodes*, *Cyrtorhyncha*, and *Pseudaphanostemma* might lead to the segregation of these from *Ranunculus* altogether. For such a purpose GOFFERT'S contribution is a very important one; and it might be stated at the same time that the same family has been treated by other pupils of GRAVIS in regard to the structure of the pericarp and spermoderm, the embryo and seedlings, etc., the result of which have appeared in the *Archives* since 1897.—THEO. HOLM.

**Prothallia of Kaulfussia and Gleichenia.**—One of the results of CAMPBELL'S recent visit to Java is the publication of an account<sup>12</sup> of the prothallia of the oriental and monotypic *Kaulfussia* and of *Gleichenia*. The account fills in an important gap in our knowledge of the prothallia and sex organs of Filicineae; and it is of interest to note that the account satisfies the desire for completeness rather than the desire for new things.

<sup>11</sup> GOFFART, JULES, Recherche sur l'anatomie des feuilles dans les Renonculacées. Arch. Inst. Bot. Univ. Liège III. pp. 187. pls. 14. 1901. The editors feel justified in calling attention to so old a publication in view of the fact that it has an important bearing upon the current taxonomic study of the family.

<sup>12</sup> CAMPBELL, D. H., The prothallium of *Kaulfussia* and *Gleichenia*. Ann. Jard. Bot. Buitenzorg II. 7:69-102. pls. 7-14. 1908.

The prothallium of *Kaulfussia* is said to be the largest among Marattiaceae, a very large one reaching  $2.5 \times 1.75$  cm; but the usual adult size is 1 cm or more in length and nearly as broad. An endophytic fungus is always present. The antheridia and archegonia, restricted to the ventral surface, are also of unusual size. CAMPBELL thinks that probably all the organs of the embryo of Marattiaceae, except the foot, are of epibasal origin, and he finds confirmation of this in *Kaulfussia*. As in other members of the family, the shoot pierces through the prothallium and emerges from the dorsal surface.

The prothallia of *Gleichenia* are also of the "massive-midrib" type, more or less lobed, and with an endophytic fungus. The antheridia are restricted to the ventral surface in all species except *G. laevigata*, in which they occur upon both surfaces. In the species examined they are larger and more complex than recorded in the species examined by RAUWENHOFF, the wall cells being much more numerous, several hundred sperm mother cells sometimes being produced, and an opercular cell probably always being present. The archegonia are more numerous upon the flanks of the "midrib" than upon its middle region; the necks are very long; and the neck canal cell (except in *G. polypodioides*) usually divides into two cells. The embryo, so far as the material permitted comparison, resembles that of the Polypodiaceae. The characteristic protostelic condition was observed in sporelings, but it was not discovered whether it persists in the adult form in all species.—J. M. C.

**Sexual reproduction in the rusts.**—During the last three or four years BLACKMAN and CHRISTMAN have described a process of sexual reproduction in the rusts. Their accounts are not in entire agreement, and so the ground has been traversed by OLIVE,<sup>13</sup> with an unusual wealth of material. About forty species were examined, and the most favorable form for the study undertaken proved to be *Triphragmium ulmariae* (Schum.) Link, on *Ulmaria rubra* Hill, a caecoma form similar to the species of *Phragmidium* studied by BLACKMAN and CHRISTMAN. The two fusing cells ("gametes"), as well as their nuclei, were found to be approximately equal, but for reasons given in detail it is concluded that they differ somewhat in time of development. The equality and sexual character of both the fusing cells are statements opposed to those of BLACKMAN. It is also concluded that the sterile cell (at the tip) is not an abortive trichogyne, but merely a "buffer cell" of the gametophyte. Conjugation takes place through a perforation developed in the contact-walls. It may begin through a very small conjugation pore (observed by BLACKMAN), but this is regarded as only the beginning of a larger perforation. In the study of the various vegetative nuclear divisions it was discovered that they are all mitotic, each nucleus during the conjugate divisions acting independently. These nuclear divisions, conducted with the aid of centrosomes, are described in detail; and in *Triphragmium* it was ascertained that the chromosomes are probably eight in number. The occur-

<sup>13</sup> OLIVE, EDGAR W., Sexual cell fusions and vegetative nuclear divisions in the rusts. *Annals of Botany* 22:331-360. *pl.* 22. 1908.